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VIKING LABORATORIES INC.

Manual of Instructions

MODEL 3265
Universal
Gaussmeter

RFL Industries, Inc.
Boonton, New Jersey, U.S.A.

THIS BOOK TO BE USED WITH EQUIPMENT

SERIAL NO. _____

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MODEL 3265

Universal Gaussmeter

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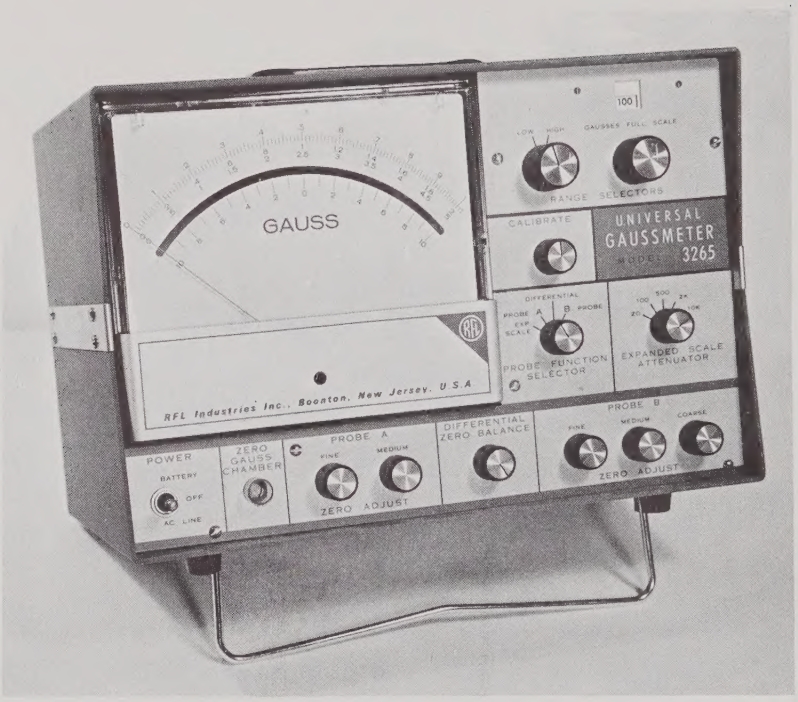


Figure 1. Front View of Model 3265 Universal Gaussmeter Bench Mounting

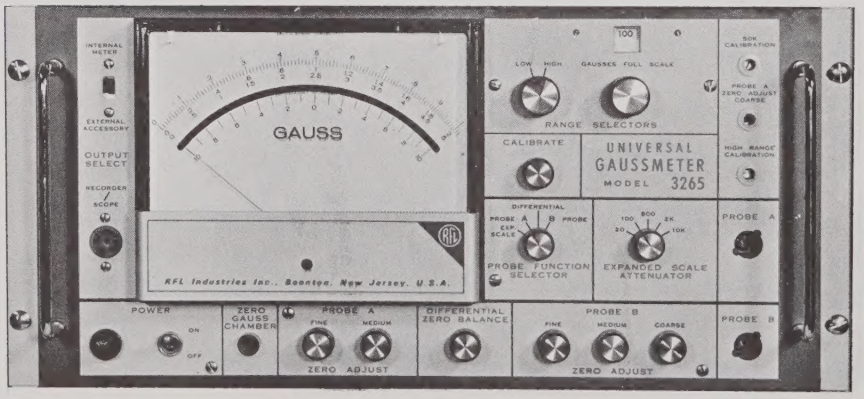


Figure 1A. Front View of Model 3265 Universal Gaussmeter Rack Mount

GENERAL DESCRIPTION

PURPOSE

Model 3265 Universal Gaussmeter is capable of three distinct modes of operation. The unit will measure absolute magnetic field densities, make differential or gradient flux measurements and detect incremental variations of a field, thus resulting in a gaussmeter having maximum versatility.

The unit is completely transistorized, providing high stability and virtually no warm-up time. Operation can be either from 115/230-volt AC power line or standard type TR 235R Mallory mercury cells (not supplied). The indicating meter is a large, easy-to-read taut-band suspension instrument. The scale has parallax compensation which makes precise readings a relatively easy accomplishment. Twenty-four overlapping ranges can be selected from 0.1 gauss full-scale, to 50K gausses full-scale. Scale factors are arranged on a 1-2-5 basis, providing a maximum of resolution with a minimum of reading error.

Absolute flux density measurements are performed using one Hall probe. The same single probe is used for expanded scale operation. The expanded scale feature allows investigation of incremental field variations in the presence of a large magnetic field. For example, determinations of flux variations as small as .001 gauss may be observed in a field of 100 gausses.

The differential operation requires the use of two matched probes. Simultaneous difference readings can be taken in a given field, or two fields may have their differences measured at the same instant. This feature is especially valuable where the field(s) are varying in amplitude and instantaneous comparisons are required. Receptacle and selector switch is included on the back of the Model 3265 for using external accessories for read-out, such as an oscilloscope, recorder or digital voltmeter. A zero gauss chamber consisting of concentric mu-metal shields is built into the front panel of the Model 3265. This feature facilitates electrical balance of the Hall probe(s) in a near zero field level.

The Model 3265 will measure magnetic field densities to a high degree of accuracy. It is a complete instrument in every respect for making direct measurements of flux density and for analyzing location, variations, homogeneity and intensity of stray magnetic fields. Some specific engineering and production uses include measurement of magnetic fields around cables, motor field intensities, relay design effectiveness and minimum leakage paths, transistor and printed circuit fields, minimum fields around shielded magnetrons, ship and aircraft compasses, ferrite isolation fields, shaker table stray fields, effectiveness of shielded rooms, meter magnets, fields around phono pickups, and high impedance input transformers and pre-amps.

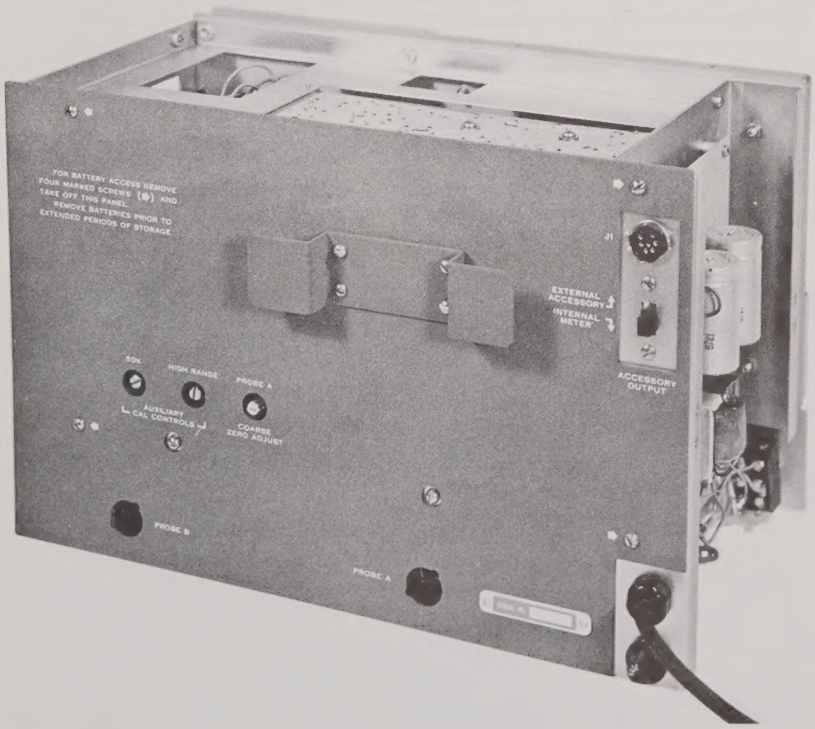


Figure 2. Rear View of Model 3265

DESCRIPTION

The Model 3265 with exception of its operating accessories (probes, reference magnet), is completely self-contained in a metal case measuring 13½ inches wide, 9½ inches high by 8½ inches deep and weighs 18 lbs.

The extra large taut-band suspension meter on the front panel is equipped with a knife edge pointer and mirror scale for parallax correction. The meter is a core magnet type producing practically no stray fields to affect measurements made close to it. The meter mechanism provides better than 0.2 scale division repeatability, and its extra long scale with linear divisions allows for better than .001 gauss resolution of reading on the lowest scale.

A zero-center scale is provided for use in the expanded scale mode, although zero left operation can also be used if desired. This enables changes of polarity to be determined while probing minute field variations. The 1-2-5 scale factor provides a generous overlapping of ranges and enables reading to be made from .02 gauss to 50,000 gausses using only the top 3/5 of the meter scale.

All controls required for normal operation are located on the front panel adjacent to the meter, Figure 1. The RANGE SELECTOR switches provide for the selection of 24 full-scale ranges divided into two groups: a LOW of 12 ranges from 0.1 to 1000 gausses and a HIGH of 12 ranges from 10 to 50,000 gausses. The overlapping of portions of these ranges facilitates smooth continuity of operation. The ZERO ADJUST controls, marked medium and fine, (Probe A) and coarse, medium and fine (Probe B), are used to adjust the Model 3265 to minimum meter reading with the probe inserted in the Zero Gauss chamber. The CALIBRATE control serves as the means by which full scale setting of the meter pointer is accomplished when the probe is inserted in a Reference Magnet.

A shielded, Mu-metal zero gauss chamber is mounted back of the front panel with access through a hole in the panel. An additional 0-gauss chamber is available together with a transparent plastic tube guide which is inserted in both the zero gauss chamber and the 100-gauss reference magnet. When mounted on the wood stand as shown in Figure 5, this assembly provides a convenient and accurate setup for zero balancing and calibrating both probes while held in the spacer block. The flattened end of the tube, which is inserted in the reference magnet, holds the spacer block so that both probes are exactly normal to the field of the magnet.

PROBES

Both the flat and axial probe types are constructed of non-metallic glass reinforced epoxy and are equipped with light, flexible cables for probing narrow apertures with a maximum sense of "feel" for the delicate element embedded in the tip. A typical flat probe for measuring transverse fields and an axial probe for magnetic fields parallel to its long axis are shown in Figures 3 and 4. Standard cables are 5 ft. long with extension cables available up to 50 ft. in length. Presently available, standard InAs probes are:

FP-025 Flat .025" thick x .203" wide x 1" long
FP-020 Flat .020" thick x .125" wide x .281" long
TP-040 Tangential .040" thick x .203" wide x 1" long
FP-039 Flat 1mm (.039") thick x .203" x 1" long
AP-312 Axial .312" diam. w/5 ft. cable
AP-200 Axial 0.20" diam. w/5 ft. cable
AP-156 Axial .156" diam. w/5 ft. cable
AP-100 Axial 0.10" diam. w/5 ft. cable
AD-312 Axial Diff. .312" diam. w/5 ft. cable

Flat and axial probes should be handled carefully and stored in their plastic box when not in use. The InAs element is extremely brittle and should never be subjected to squeezing or bending.

Each probe is supplied with a test data sheet which contains electrical and temperature stability values measured for that probe, plus calibration data for each range as measured using laboratory standard reference magnet fields for each full-scale range.

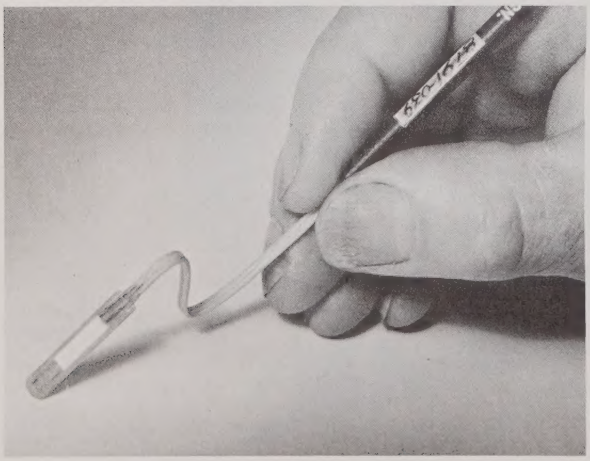


Figure 3.
Showing Flexibility of Probe Cable.

Figure 4.
Typical Axial Probe.

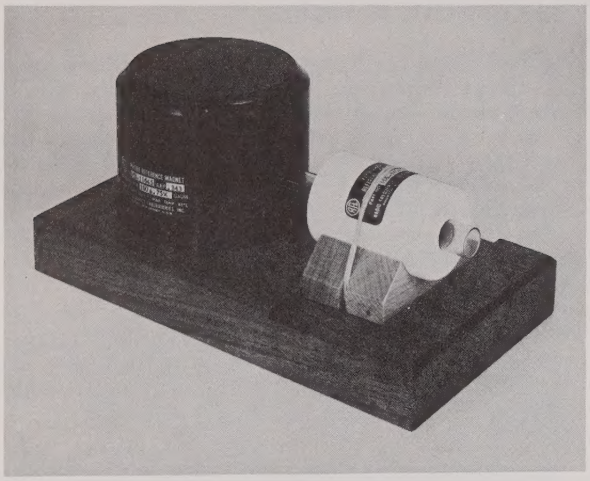


Figure 5.
HA–16440 Stand Assembly.

Since sensitivity of InAs decreases above 10,000 gausses, down-scale data are particularly necessary on the 50,000-gauss range. This permits use of the 50,000-gauss range in making measurements above 20,000 gausses.

Flat and axial probes are available for absolute and incremental or differential use.

PROBE REFERENCE MAGNETS

The 100 gauss Flat Probe Reference Magnet .343 inch gap is accurate to ±1.0%. The 100 gauss reference magnet is suggested for versatility when calibrating the Model 3265. The gap is large enough for insertion of 2 probes in spacer block when operating in the differential mode.

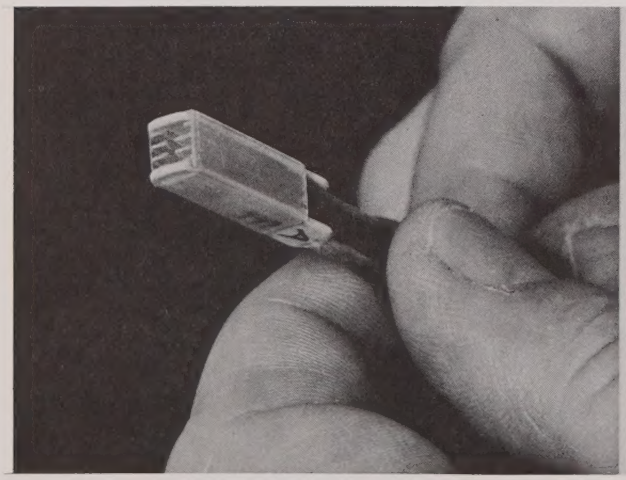
The F062-1K gauss ±0.75% with .062 Flat Probe reference magnet can be used for increased accuracy. The narrower gap dictates single probe calibration only.

All axial probes should be calibrated using the A312-100 100 gauss ±1.5% axial reference magnet. In addition to the suggested values, reference magnets having values from 50 to 20,000 gausses can be supplied. Some of these are listed below. Specify field desired.

PART NO.	VALUE	GAP
F062-200	200 gauss ±1.5%	.062"
F062-500	500 gauss ±1.5%	.062"
F062-1K	1 kilogauss ±0.75%	.062"
F062-2K	2 kilogauss ±0.75%	.062"
F062-5K	5 kilogauss ±0.75%	.062"
F062-10K	10 kilogauss ±0.75%	.062"
F040-15K	15 kilogauss ±0.75%	.040"
F040-20K	20 kilogauss ±0.75%	.040"
F343-50	50 gauss ±1.0%	.343"
F343-100	100 gauss ±1.0%	.343"
F343-200	200 gauss ±1.0%	.343"
F343-500	500 gauss ±0.75%	.343"
A312-100	100 gauss ±1.5%	.312"
A312-500	500 gauss ±1.5%	.312"
A312-1K	1 kilogauss ±1.5%	.312"
A312-2K	2 kilogauss ±1.5%	.312"

*The A312 series reference magnet is supplied with sleeves of .200, .156 and .100 diameter gap depending on probe diameter supplied.

These reference magnets are stabilized and adjusted using mutual inductors and search coils with National Bureau of Standards certificates. The magnets are coaxial to eliminate stray fields in the areas of measurement and to protect against possible magnetic change in the reference when contacting other strong magnets. The pole faces are accurately machined of special alloys to provide uniform flux distribution.



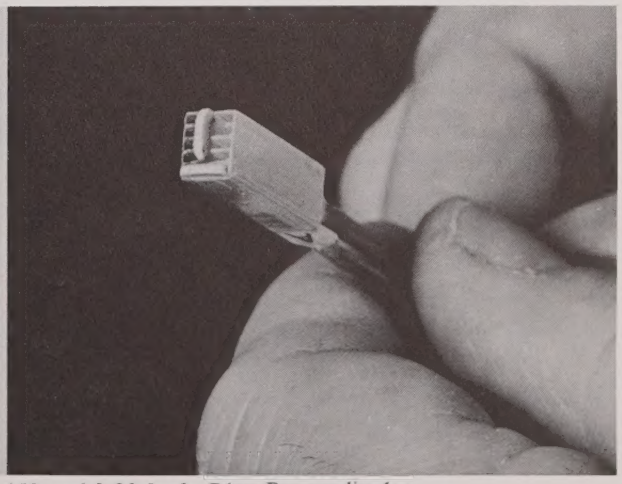


Figure 6. Parallel Spacing of .050, 0.10, 0.150 and 0.20 Inch, Plus Perpendicular Position, are Provided by Split Spacer.

POWER SUPPLIES

The Model 3265 is designed for use on a 115 or 230-volt 50/60 Hz line or for battery operation.

The AC power supply delivers an 18-volt DC output at 30 mA and can be internally connected for 115-volt or 230-volt operation. The line cord is an approved 3-conductor power cable and plug with grounding pin.

For battery operation 3 mercury cells type TR 235R at 6.75 volts can be installed. A set of these cells will supply about 100 hours of operation. For normal laboratory or field use, battery operation is most convenient. For continuous service or daily production use, the AC supply is recommended.

TABLE 1

Limits of Error
in the Calibration of a ±3/4% Reference Magnet

Error	Description
±0.25%	Bureau of Standards accuracy of calibration of search coil.
±0.05%	Bureau of Standards accuracy of measurement of mutual inductor.
±0.10%	RFL accuracy of measurement of DC current.
±0.20%	RFL fluxmeter transfer reading error.
±0.15%	Non–uniformity of field in gap.
±0.75%	Maximum error.

ELECTRICAL FEATURES

Basically, the Model 3265 consists of two probes, (for most versatility), a 3000 Hz oscillator, two constant current amplifiers, two matching filters, an adder circuit, a precision attenuator, an amplifier, a linear rectifier, a meter and a power supply (AC or battery). The use of transistors throughout provides maximum temperature stability, reduces warm-up time and permits economical battery operation for field use in addition to AC line operation.

The amplifier is linear and powerful enough to drive an external recorder. There is an output receptacle on the back panel (See Figure 2) for an external recorder, oscilloscope, and digital voltmeter.

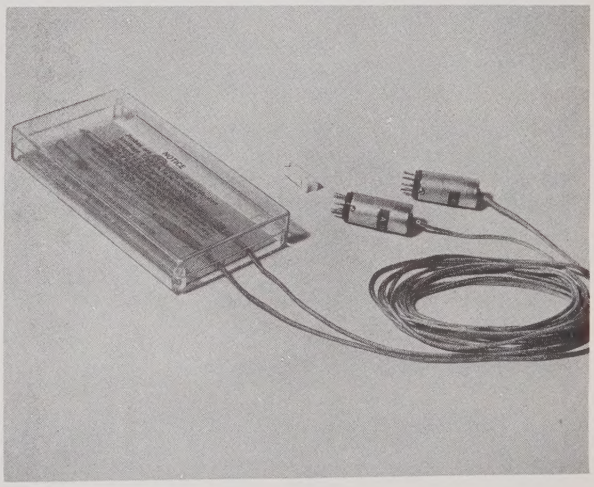


Figure 7.
Keep Probes in Box When Not Being Used.

Technical Data Summary

Accuracy:

±(1% plus reference magnet accuracy) full–scale. Downscale linearity better than 0.5% of full–scale.

Overall accuracy (using 1000–gauss reference magnet) ± 3% of full-scale range value to 10,000 gauss. On the 20,000 and 50,000–gauss ranges, probe linearity data must be used to obtain specified accuracy. All calibration data traceable directly to the National Bureau of Standards through reference standards maintained at RFL and periodically checked by NBS.

Probe data is supplied to 25,000 gausses.

Measurement Ranges: Gauss full–scale

Low: 0–0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200 and 1000.

High: 0–10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10,000, 20,000 and 50,000.

Residual Noise:

Less than 10 millgauss.

Magnet Field Frequency:

Permanent magnetic and electromagnetic fields and AC fields from 20 Hz to 400 Hz. On AC fields, gaussmeter reads average value. Correction data for fields above 60 Hz are supplied.

Supply:

Internal AC supply, 115/230 volts 50/60 Hz, 5 watts. 3 mercury cells, Mallory type TR235R at 6.75 volts will operate instrument approximately 100 hours.

Accessory Outputs:

Accessory output receptacle is located on rear of cabinet.

Oscilloscope: 2 volt maximum. Display includes 3000 Hz carrier frequency unless external filter is used.

Recorder: 1mA DC into 1500 ohms. A digital voltmeter may also be used on the recorder output connection.

Reference Magnets:

A wide variety of reference magnets are available. For maximum versatility the type F343-100 magnet (100 gauss ±1% with .343" gap) is recommended. This calibration standard will permit operation of the Model 3265 in all three modes of operation and over all ranges.

The A312-100 (100 gauss ±1.5%) magnet is used for all axial probes.

The F062-1K (1000 gauss ±0.75% with .062" gap) magnet can be used for absolute measurements with a single flat probe over the ranges from 1 gauss to 20K gauss FS, providing slightly higher accuracy and at less cost.

Probes:

Various flat or axial probes are available. Single probes are used for absolute and expanded scale measurement. Two matched probes are used for differential operation. They can be either flat or axial probes.

THEORY OF OPERATION

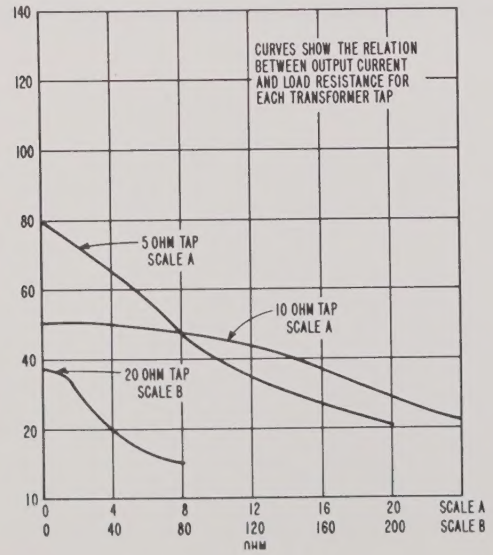
THE HALL EFFECT

When electrons move in a conductor perpendicular to a magnetic field, they are deflected toward one side of the conductor (left or right depending on the direction of the magnetic field) in a direction normal to the direction of both the initial electron flow and the magnetic field. The force deflecting the electrons is directly proportional to the electron velocity (current) and the magnetic field intensity. This deflection process continues until sufficient charge has accumulated at the sides of the conductor to establish a transverse electric field which opposes further deflection of charge carriers. The transverse potential difference thus created is called the Hall voltage and the phenomena causing it, the Hall effect. The magnitude of this potential in volts is given by the equation:

$$E = \frac{RIH}{t}$$

where I is the current in amperes, H is the magnetic field strength in gauss, t is the thickness of the sample in the centimeters, and R is the Hall coefficient in volt-cm/ampere gauss.

Under the conditions shown in Figure 8, the terminal B will be negative with respect to terminal A for metals and semiconductors in which the current is carried by electrons. Reversing the field reverses the output polarity. As shown by the equation above, the width of the strip is not a factor of the output as it is large compared to the thickness. The strip should be twice as long as it is wide or the output drops off. For thin strips the output is unaffected by the frequency of the field in the audio range. The Hall voltage is maximum when the plane of the element is perpendicular to the magnetic field.



3000 Hz Oscillator Output

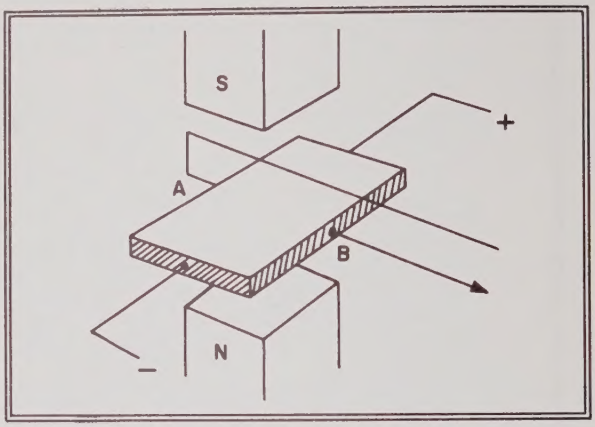


Figure 8. Schematic Circuit Arrangement for the Measurement of the Hall Coefficient.

Practical materials for Hall elements are films and slabs of specially refined semiconductors. The sensitivity temperature stability and linearity to fields can be varied through wide ranges by selection of materials. One characteristic can usually be improved at the expense of the other characteristics. Hall elements made of InAs, InSb and other similar III-V compounds require a loading resistor across the Hall contacts for best linearity in strong fields above 2000 gausses. This resistor is determined experimentally for each element.

Flat and axial probes for the Model 3265 Gaussmeter are manufactured using a very thin piece of InAs which is selected for use in the temperature range of -40°C to +85°C.

PROBE SENSITIVITY

The Hall elements normally used with the Model 3265, as matched to an output load for best linearity, will supply 2.5 mV output when subjected to a 1000-gauss field and driven with 50 mA ±20%. The average value of K is 50 x 10^{-6} in the formula: V_H = KHI, where V is the Hall voltage in volts, H is the magnetic field in gauss and I is the current in amperes.

CIRCUIT ARRANGEMENT

Figure 9 is a block diagram of the major circuits; these can be switched to measure either the flux density or the gradient of a magnetic field.

The 3000 Hz oscillator is designed to supply a constant current to the current terminals of the probe elements. The potential leads are brought from the probes to their respective 3000 Hz filter, each having a 1000 Hz bandwidth. A balancing network is provided to inject small voltages into the pick-up loop to balance out the residual resistive unbalance in each probe. The ZERO ADJUST CONTROLS on the front panel adjust the phase and magnitude of these injected voltages. The purpose of each filter is to remove

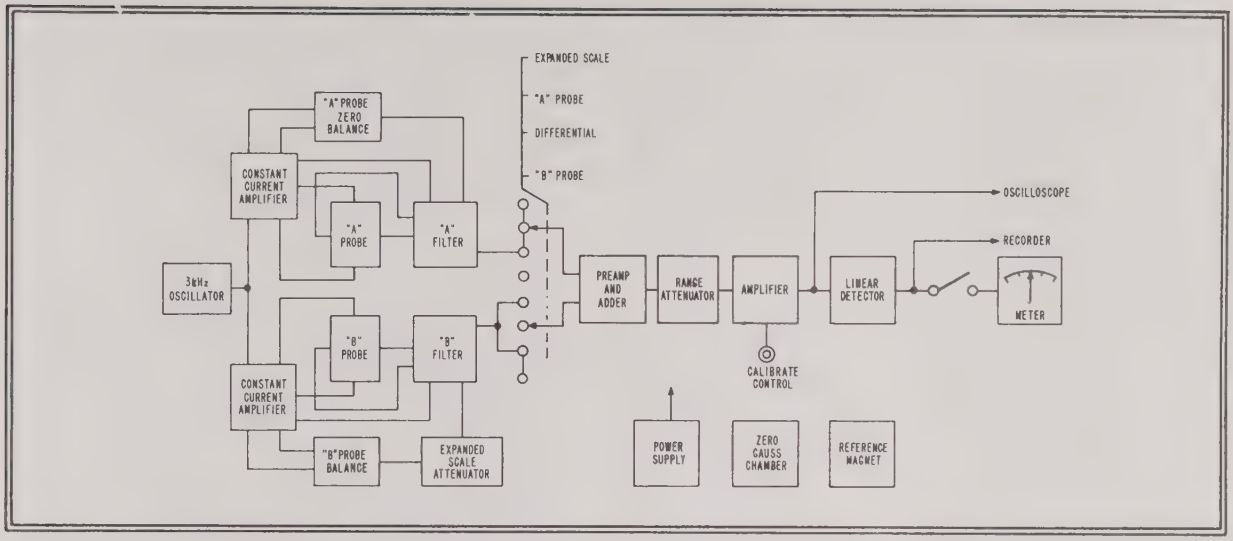


Figure 9. Block Diagram of Model 3265 Universal Gaussmeter.

harmonic voltage from the signal as generated in the 3-kilohertz oscillator and with the pre-amp adder circuit, to step up the voltage. The signal is amplified and rectified to operate the meter or external recorder. The final stage uses current feedback to improve the linearity of the meter rectifiers and is powerful enough to drive many DC recorders directly without further amplification. The over-all sensitivity is varied with a front panel CALIBRATE control.

A 12-step attenuator permits full-scale measurements from 0.1 gauss to 50,000 gausses. The pre-amp and adder circuit consists of two transistor amplifiers with a common collector load. This circuit adds the voltages from the "A" and the "B" probes and provides a gain of about 10. A regulated power supply (either battery or AC) provides the necessary DC power voltage. Semiconductor devices are used for rectification and amplification in all circuits.

Each probe is driven by a constant current amplifier to insure linearity of the probe output with applied magnetic field. The Hall voltage outputs are adjusted exactly in phase by varying the tuning of the constant current amplifiers. The relative sensitivity of the probes is controlled by adjusting the gain of one of the current amplifiers.

The output voltage of each probe is balanced as closely as possible to zero in a 0-gauss chamber by inserting small voltages of the correct magnitude and phase in series with the Hall elements. These voltages are controlled by the A probe MEDIUM and FINE ZERO ADJ. controls and the B probe COARSE, MEDIUM and FINE controls. The output voltages are then made equal with both probes held in a 100-gauss reference magnet field by adjusting the gain of one of the current amplifiers (control marked DIFFERENTIAL ZERO BALANCE). Upon proper adjustment on

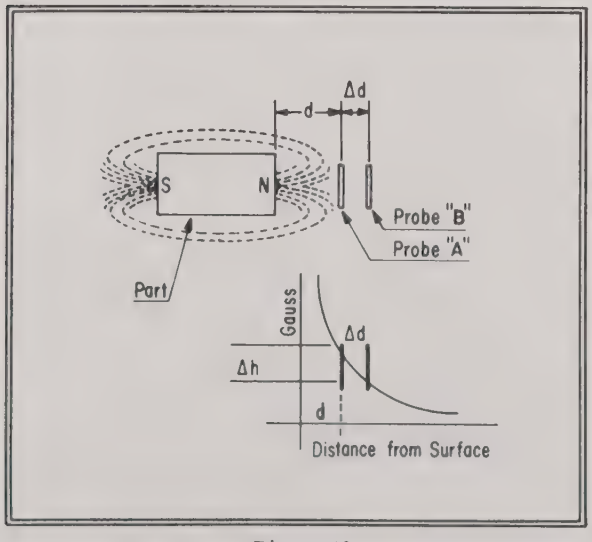


Figure 10.
Measurement of Field Gradient.

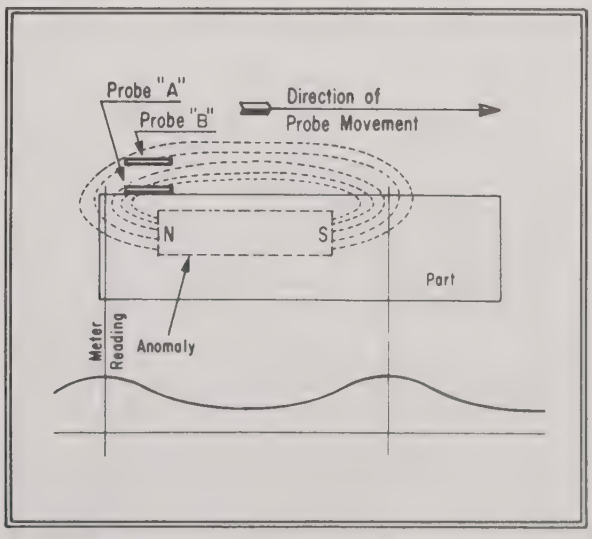


Figure 11.
Measurement of A nomaly within a Steel Part.

the 1 gauss range, the meter will read within three divisions from zero with the Gaussmeter set up for DIFFERENTIAL operation. With the RANGE SELECTOR at LOW, or HIGH (depending on field strengths to be measured) and the GAUSS FULL SCALE switch at 100, the amplifier gain is then adjusted until the meter reads full scale for either probe while both are in the reference field either probe can then be used to measure the intensity, or both can be used to measure the gradient of a magnetic field. A 100-gauss reference magnet is necessary for differential measurements, since this value is common to the LOW and HIGH range groups and has a large air gap to accept the two probes.

For gradient measurements, the phase of one of the probes is reversed, and both are switched to the adder circuit. The difference in field intensity between the two probes is indicated by the meter and is shown graphically in Figure 10.

Normally, for measuring field gradients, the probes are fitted into the holder and held in parallel planes. Anomalies or flaws within a part can be detected as shown in Figure 11. Both probes are selected and matched for uniform response, which is within 1.5% over the entire useful range for gradient or difference measurements; the probe test data sheet gives specific values for all ranges. The degree of balance attainable between both probes while in a uniform field is better than 0.25%. Highest balance accuracies are realized when both probes are balanced in a uniform field whose value approximates the field to be measured.

Expanded scale mode of operation employs one probe as in normal, absolute field measurements. In expanded scale operation, an in-phase counter-emf is applied to the amplifier circuitry enabling the gaussmeter to be zero balanced while the A probe is in the presence of a field in the range of 1 to 15,000 gausses.

TEMPERATURE EFFECTS

The resistive zero balance of the probe is sensitive to temperature; the InAs element has a temperature coefficient of resistance about the same as copper. The zero shift is, of course, most apparent on the sensitive 0.1 gauss range. This shift is about one gauss for a 10°C change in element temperature. Each probe is individually checked for temperature/stability characteristics. Refer to probe calibration data for actual values.

The Hall coefficient of the InAs material also changes with ambient temperature. The sensitivity of the probe may change approximately 0.1%/°C when submitted to temperature variations after calibrating with a reference magnet. The reference magnets change approximately 0.02%/°C; the magnet will return to its original calibration when normal temperature is restored. An ambient temperature above 180°C may permanently change the calibration of the magnet. A variation in ambient temperature also changes the rectification efficiency of the diodes in the meter circuit. These changes are normally eliminated by calibration at the temperature of use.

OPERATIONAL PROCEDURE

UNPACKING THE EQUIPMENT

For shipment in the continental United States, the equipment is packed in commercial cardboard cartons. Upon receipt, the unit should be removed from the carton and inspected for possible physical damage in shipment.

Unless specified differently on the purchase order, the AC power supply is connected for 115 volt line operation. Always check the transformer connections on the power supply board (Fig. 17) before plugging into 230 volts, see schematic wiring diagram in back of this book. For access to power supply board, remove bottom half of case. Case is fastened by screws in metal strip on sides of instrument.

When installing mercury batteries, carefully observe the polarities marked on the holder and on the side of the mercury batteries.

Keep the probes in their plastic box until ready for use. It is always a good idea to leave them in the holder for additional protection, especially when operating or checking out a Model 3265 for the first time.

CAUTION

InAs elements are brittle, are easily fractured if probe tip is bent, squeezed or flexed. Damaged probes will not be replaced under the equipment warranty.

If you do damage a probe, read Note on page 16 of the MAINTENANCE section.

ABSOLUTE MAGNETIC FIELD MEASUREMENTS

Only the A probe is used in absolute measurements. The B probe should not be plugged into its respective socket for this mode of operation.

1. Operate RANGE SELECTOR switch to LOW position and set FULL SCALE indicator to 100 gausses. Set function switch to PROBE A position.

2. For AC operation, plug line cord into power source and operate toggle switch to AC LINE. For operation from internal battery supply, stow line cord on brackets provided on rear of case and operate toggle switch to INT BAT.

3. Insert probe cable plug (Probe A) into receptacle on rear panel. (When making measurements on lower ranges, rest a suitable weight on the probe cable to prevent undue movement of the cable immediately adjacent to the plug.)

4. Carefully insert probe into ZERO GAUSS CHAMber, then slowly rotate PROBE A MEDIUM ZERO ADJUST control until minimum meter reading is obtained. Rotate FULL SCALE indicator knob through successively lower ranges, repeating the zero adjusting operation for each step until the lowest meter reading for the lowest range is obtained. Continue the above procedure using PROBE A ZERO ADJUST FINE control. Final adjustment of MEDIUM and FINE controls is achieved when a reading of less than 10 milligausses on the 0.1 gauss range is observed. It may be necessary to reset PROBE A COARSE ZERO ADJUST control if difficulty is encountered in obtaining a minimum indication. Refer to the section REAR PANEL CONTROLS on page 13.

5. Operate RANGE SELECTOR switch to HIGH or LOW position depending on value of field strength to be measured. Set FULL SCALE indicator to value marked on reference magnet.

6. Remove probe from ZERO GAUSS CHAMBER and carefully insert it into the center of the reference magnet, positioning the probe so as to obtain maximum meter reading. With CALIBRATE control adjust reading to exact full scale value marked on reference magnet. (When using flat probe, turn it over 180° and calibrate in position producing greatest reading.)

7. Remove probe from reference magnet and place it in field to be measured. Position probe so that lines of force are perpendicular to probe sensing element. Operate FULL SCALE indicator control to range providing highest on-scale meter reading.

INCREMENTAL VARIATION OF A FIELD

The A probe only is used for this type of measurement. The B probe should not be plugged into its respective socket for this mode of operation. Repeat steps 1 through 6 under Absolute Magnetic Field Measurements.

1. Place the probe into the magnetic field under study.

2. Turn the mode switch from the A PROBE position to the EXPANDED SCALE position.

3. Place the EXPANDED SCALE ATTENUATOR switch to the same or nearest higher value as the GAUSSES FULL SCALE switch (for values below 20 gausses set the EXPANDED SCALE ATTENUATOR switch to the 20 position and for values above 10 kilogauss use the 10K position).

4. Adjust the B PROBE COARSE control for downscale deflection (towards zero) of the Meter Pointer. With the other hand, rotate the GAUSSES FULL SCALE control step-by-step through lower ranges until no closer deflection to zero can be accomplished. Then repeat adjustment with the MEDIUM control and finally with the FINE control. It may be necessary to readjust the MEDIUM control. Typical suppression and resolution values are given in Table 2, page 13.

5. Turn the GAUSSES FULL SCALE control to a range equal to, or greater than, 10 times the null value obtained in Step 4, and using the PROBE B FINE ZERO ADJUST control only, set the meter pointer to center scale. Do not disturb the MEDIUM control setting. The lowest meter scale is to be used for expanded scale operation, with 10 scale divisions corresponding to half of the GAUSSES FULL SCALE setting. The instrument is now adjusted for monitoring incremental field variations.

DIFFERENTIAL OR GRADIENT FLUX MEASUREMENTS

The A and B probes (matched pair) are required and should be inserted in their respective sockets. It will be necessary to use a reference magnet with a gap large enough to fit the probe holder assembly HB-16795. It is recommended that the Calibration Assembly, HA-16440, which includes a 100 gauss Reference Magnet, be used.

1. Insert both probes in the holder supplied (illustrated in Figure 6) into the ZERO GAUSS CHAMBER.

2. Place the function selector to the A Probe position.

3. Set the RANGE SELECTOR to the LOW position and the GAUSSES FULL SCALE TO 1K.

4. Repeat Steps 4, 5 and 6 under Absolute Field Measurements.

5. Turn the GAUSSES FULL SCALE back to the 1K gauss range and rotate the function switch knob from the A PROBE to the B PROBE position.

6. Repeat Step 4 under ABSOLUTE FIELD MEASUREMENTS using the three B PROBE ZERO ADJ. controls. These controls are indicated as COARSE, MEDIUM and FINE and they should be adjusted in this sequence. Note: If the meter deflects beyond full scale, place the GAUSSES FULL SCALE switch to a higher range until a normal meter deflection is obtained.

7. Turn the GAUSSES FULL SCALE control to the value of the Reference Magnet used.

8. Carefully insert the probes into the center of the Probe Reference Magnet.

9. Change the function switch from the B PROBE to the DIFFERENTIAL position and adjust the DIFFERENTIAL ZERO BALANCE control for closest to zero deflection of the meter. (If the meter deflects off-scale to the right, probes are out of phase and one should be rotated 180°.) Note the position of the serial numbers for future orientation.

10. Place both probes in ZERO GAUSS CHAMBER and recheck zero balance for each probe. (See Steps 5 and 6 above.)

11. Return both probes to the Reference Magnet and recheck the calibration point for Probe A, readjust if necessary.

12. Turn the function switch knob to the DIFFERENTIAL position and with the DIFFERENTIAL ZERO BALANCE control adjust the zero deflection of the meter while rotating the GAUSSES FULL SCALE SELECTOR down range. Minimum obtainable deflection will be about mid-scale on the 0.1 gauss range; the value recorded during calibration is shown on the Probe Test Data Sheet opposite A-B (Differential) for each set of probes. If minimum attainable deflection exceeds this value by 50% or more, an adjustment inside the Model 3265 must be made. (See paragraph BALANCING EXTRA PROBE SETS on page 14.)

13. Probes are now balanced, calibrated and ready for use.

POLARITY OF MAGNETIC FIELDS BY CENTER SCALE POSITIONING OF THE METER POINTER

Only the A probe is used in this type of measurement. The B probe should be removed from its socket.

1. Place the function selector in the PROBE A position. Repeat Step 4 under Absolute Magnetic Field Measurements.

2. Select a Reference Magnet equal to or greater than the magnet to be tested. The Reference Magnet should have a value corresponding to a full scale range of the Model 3265.

3. Repeat Steps 5 and 6 under Absolute Magnetic Field Measurements, except in Step 5 set the GAUSSES FULL SCALE control to a value two times the Reference Magnet value, and in Step 6 adjust the CALIBRATE control for center scale.

4. Turn the function selector from the PROBE A position to the EXP. SCALE position.

5. Set the EXPANDED SCALE ATTENUATOR switch to the same or nearest higher value corresponding to the Reference Magnet used.

6. With the probe in the Reference Magnet adjust the PROBE B ZERO ADJUST controls for minimum meter indication, left of zero center, as described in Step 4 under Incremental Variation of a Field. Leave the LOW-HIGH range selector switch in the same position used in Step 3 above.

7. Return GAUSSES FULL SCALE control to setting used in Step 3 above. Remove probe from Reference Magnet. Meter indication should be within a few divisions of zero center. Readjust the PROBE B ZERO ADJUST COARSE or FINE controls for zero center. Do not disturb the MEDIUM control.

8. The instrument may now be used for magnetic field polarity measurements.

OPERATIONAL CONSIDERATIONS

After the setting up procedure has been performed under DIFFERENTIAL or GRADIENT FLUX MEASUREMENTS, the A probe and the B probe may be used

separately for single probe operation by turning the function switch to the appropriate A or B probe position.

A zero center scale is provided for use in the expanded scale mode to allow changes of polarity to be determined while probing minute field variations. Larger changes of polarity can be observed using the procedure for POLARITY OF MAGNETIC FIELDS BY CENTER SCALE POSITIONING OF THE METER POINTER.

NOTE

Flat probes supplied with the Model 3265 Gaussmeter should be calibrated with 100-gauss reference magnet unless otherwise noted on Data Sheet.

When operating in the expanded scale mode, the range selector switch must be kept in one position (Low or High) to avoid overdriving the summing amplifier. The amount of suppression available depends on the range in use. For example, the typical suppression is down to 0.5 gauss in a 10,000 gauss field and down to 0.01 gauss in a 100 gauss field. This will result in a maximum resolution of field variations on the order of 10 ppm, based on a meter scale resolution of 1 division.

Table 2 contains a chart listing typical suppression and resolution data. The suppression figure given refers to the minimum meter indication obtained during the setting up procedure for Expanded Scale Operation.

On the ranges below one gauss, temperature becomes an increasingly important factor. Temperature change effect is given in the Probe Test Data Sheet. Also, any mechanical strain applied to the element is readily indicated. Both conditions can be observed by breathing on the probe and lightly touching its end after zero balancing. Moving the cable excessively (especially where it enters the plug body) can cause erratic readings on the 0.1 gauss range, hence taping the cable to the case or resting a weight on it is recommended during the zero balancing procedure, and for low field measurements.

Magnetic measurements can be made intermittently or continuously over periods of several days. Provided the ambient temperature remains reasonably constant (±2°) and the line voltage stays between 100 and 130 volts, the stability of the system is such that readings will not deviate more than 1% from nominal.

REAR PANEL CONTROLS

ZERO ADJUST COARSE A PROBE–Initial balance adjustment using this control may be required when original probe shipped with Model 3265 is replaced, or when a different Hall element probe is used. Adjustment using this control should be made in conjunction with Step 4 under Absolute Field Measurements on page 11.

HIGH RANGE CALIBRATE–This control serves to compensate for the resistive unbalance between common values on the LOW and HIGH ranges. When setting up to perform a span of continuous measurements, for example from 1 gauss to 10K gausses, the full scale adjustment (Step 6, Absolute Field Measurements) for the LOW ranges is obtained using the CALIBRATE control on the front panel. To obtain full scale adjustments for the same value on the HIGH range, use the HIGH RANGE CALIBRATE control on the rear panel. This procedure will eliminate the introduction of an error of up to 3% when shifting back and forth between the LOW and HIGH ranges.

TABLE 2

The following are typical examples of performance on a general cross section of ranges.

Full–Scale Range (Gausses)	Maximum Suppressions and Resolutions
100	Suppression to 0.01 Gauss Resolution: 1 Scale Div. = 0.001 Gauss
500	Suppression to 0.02 Gauss Resolution: 1 Scale Div. = 0.001 Gauss
1,000	Suppression to <0.05 Gauss Resolution: 1 Scale Div. = 0.001 Gauss
2,000	Suppression to <0.1 Gauss Resolution: 1 Scale Div. = 0.1 Gauss
10,000	Suppression to <0.5 Gauss Resolution: 1 Scale Div. = 0.1 Gauss
15,000	On the 20,000 range Suppression to <1 Gauss Resolution: . Scale Div. = 0.1 Gauss

NOTE: Ranges from 1 to 10,000 gausses full scale (and to 15,000 gausses to 20,000 gausses full scale range) can be used in expanded scale mode of operation. The above data show typical suppression characteristics. Ranges below 1 gauss full scale may be used in expanded scale operation; however, the residual amplifier noise (which may approach 0.01 gauss) can effect readings on the lower ranges.

50K CALIBRATE–The measurement of magnetic fields in the order of 20K to 50K requires the use of a special probe and a high value reference magnet. Zero adjustment is made as outlined in Step 4 above, then the calibration is made using the 50K CALIBRATE control and the data supplied with probe.

USE OF PROBE TEST DATA

InAs Hall effect devices become nonlinear in fields near zero and in excess of 20K gausses. Above 10K gausses the response falls off fairly rapidly, and calibration data, or correction factors are necessary. Using a 1000 gauss reference magnet certified to an accuracy of ±¼% or better, direct reading accuracy on all full-scale ranges from 0.1 to 10K gausses will be within ±3%. For accuracy approaching ±1%, the meter reading may be corrected with the calibration data furnished.

Where different types of probes are used, check the Test Data Sheet for each to determine the value of reference magnet for calibration. All dual, flat and axial probe sets for the Model 3265 are matched to operate with ±1.5% in their readings. However, replacement set may require internal balance adjustment when used in the differential mode. See below.

BALANCING EXTRA PROBE SETS

When replacement dual probe sets are to be used on a Model 3265 already in service, or extra probe sets are to be used on a Model 3265 already in service, or extra probe sets are ordered for the Model 3265, an internal balance adjustment may have to be made to permit balancing both probes (of extra set) in the differential mode position.

This condition can be determined at Step 12 under the setting up procedure for DIFFERENTIAL OR GRADIENT FLUX MEASUREMENTS. (Be sure to complete all preceding steps.) With all steps up to and including 12 completed, the minimum attainable deflection should be about mid-scale on the 0.1 gauss range; the value recorded during calibration is listed on the Probe Test Data Sheet opposite A-B (Differential) for each set of probes. If minimum attainable deflection exceeds this value by 50% or more, an internal trimmer capacitor has to be adjusted on the B probe oscillator. This adjustment can be made through the bottom case half. Tilt the Model 3265 on its left side, this will expose a screw driver adjustment hole for the trimmer capacitor C40. Repeat the DIFFERENTIAL ZERO BALANCE control adjustment in step 12, then adjust C40 for minimum meter pointer deflection. It may be necessary to repeat these two adjustments several times to achieve the value nearest to zero on the 0.1 gauss range. The Model 3265 will then be adjusted for optimum differential balance for the particular set of probes.

MOST ACCURATE MEASUREMENT OF FIELDS FROM 10K TO 30K GAUSSES

By using selected InAs elements, it is possible to provide flat probes and calibration curves for field measurements to 30K gausses. Two choices are presently available: Option "A" and Option "B"

Option "A": Where single flat probe magnetic field measurements are to be made from 10K to 20K gausses and maximum accuracy is desired, a selected probe and calibration curve plotted from 5K to approximately 25K gausses can be purchased. The curve is in addition to the Probe Test Data Sheet normally supplied. A 1000 gauss reference magnet is also required. Accuracy of measurement will be within ±3% from 1 to 20K gausses overall and within ±1% to ±2% on many of the ranges.

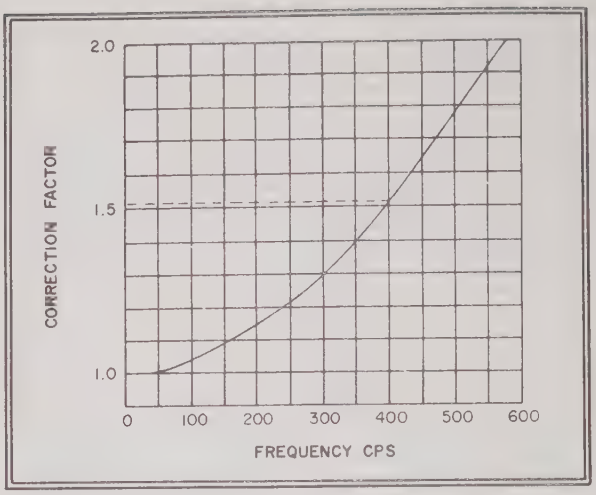


Figure 12.
Frequency Response of Model 3265 Gaussmeter.

Option "B": Where single probe field measurements in the range of 20K to 30K gausses are desired, a selected probe and calibration curve plotted from 5K to 27K gausses can be supplied. A 10K gauss reference magnet is required and using the data from the curve, measurements can be made to an accuracy of ±1% from 5K to 30K gausses. This probe is not calibrated below 5K gausses and, due to its nonlinear characteristics at lower ranges, should not be used for low level work.

AC FIELDS

When the probe is placed in an AC magnetic field the meter reads the average value of the field. For sine wave fields above 50 Hz, multiply the meter reading by the correction factor given in Figure 12. If the wave shape of the field is of interest, a rear panel test mount is provided. The oscilloscope output is taken across T2 and displays the carrier and its envelope. The peak signal can be set at 2 volts for full scale. The output may be termed as double sideband with suppressed carrier.

It should be noted that the expanded scale feature is applicable only to fixed magnetic fields. Fields having a repetitive rate of change, such as an AC field, cannot be measured in the expanded scale mode.

EXTERNAL ACCESSORIES

A seven pin receptacle with locking plug is provided on the rear panel of the unit for connection by suitable cable to an external recorder, oscilloscope or digital voltmeter. The Model 3265 Gaussmeter will accommodate either D'Arsonval or electronic chopper

type recorders. The output for external accessories is 1 mA into 1500 ohms.

When connecting an external accessory, care should be taken to properly wire the accessory cable and plug as follows:

Recorder or Meter (D'Arsonval type approximately 1500 ohms)–Connect the positive side of the recorder (or meter) to terminal "B" of the plug and the other side to terminals "D" and "E". The METER switch should be in the EXT position.

Recorder (chopper type) or Meter (digital)–Connect the positive side of the recorder (or meter) to terminal "B" of the plug and the other side to terminal "D". The METER switch should be in the INT position.

Oscilloscope–Connect one side of the oscilloscope to terminal "A" of the plug and the other side to terminal "E". The METER switch should be in the INT position.

When returning to the use of the built-in meter of the Model 3265, place the METER switch in the INT position and remove the external accessory cable plug.

MAINTENANCE

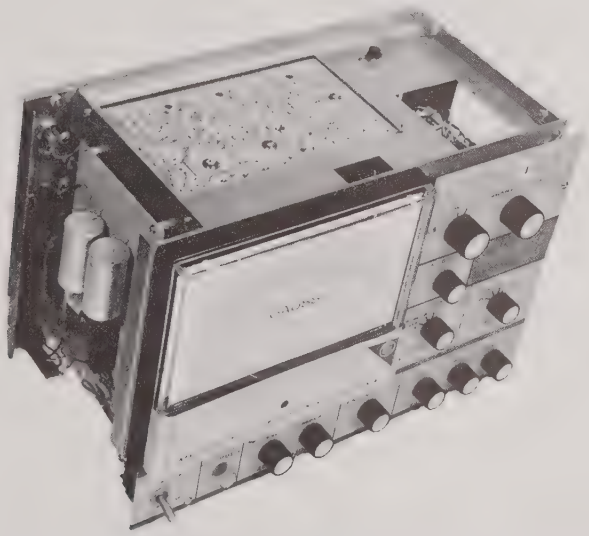


Figure 13. Inside View Showing Major Assemblies.

NOTE

Be certain the DIFFERENTIAL ZERO BALANCE control on the front panel is set near the mid-point of its range for both "A" and "B" probe oscillator adjustments.

CALIBRATION PROCEDURE

Oscillator HC-24845 - As shown in the schematic diagram (foldout at end of book) the oscillator coil L2 has a multi-tap secondary for matching into the current terminals of the Hall element. The wiring in the probe selects the proper tap for each probe element. The adjustment of the oscillator consists of setting the OSC. GAIN control R15 on the oscillator unit for an output or drive voltage of 0.1 volt after inserting a 2-ohm, ±1% resistor between pins 1 and 2 of the "A" probe receptacle on the rear panel of the gaussmeter.

Oscillator Amplifier - Adjustment of this oscillator is similar to oscillator for "A" probe. Connect a 2 ohm ±1% resistor between pins 1 and 2 of the "B" probe receptacle (back panel of gaussmeter) and adjust R90 to 0.1 volt.

A trimmer capacitor C40 in the collector tank circuit is to adjust the phase of the "B" probe output voltage to be exactly in phase with the "A" probe output. The capacitor C40 is adjusted in its initial alignment with the DIFFERENTIAL control set to the DIFFERENTIAL position.

Pre-Amplifier Adder - This amplifier is checked by applying signal to one input and then the other while measuring the output. The gains of each channel should be equal with capacitor C30 and C34 grounded or open in HIGH position of range switch. The output should be held under one volt. Signal can be applied to the inputs by subjecting the probes one at a time to a 1000-gauss field.

Hall Probe Elements - The nominal resistance of InAs probes is 2 ohms between the current leads and 1 ohm between the Hall contacts. The 3000 Hz current through the current contacts is, therefore, approximately .050 ampere.

Load resistors, when required for best linearity to strong fields, are determined for each Hall probe and mounted in the connector plug (See schematic diagram). The procedure for determining the load resistor for the "A" probe Hall element is to connect a variable resistance box across pins 5 and 7 of socket J2 (see schematic diagram) and adjust the resistance of the box so that full-scale readings on the 1000, 2000, 5000, and 10,000-gauss ranges are within 3% of the full-scale mark. This requires probe reference magnets at the above values. With the probe unloaded, the readings at 5000 and 10,000 gausses will be low by about 4% to 8% when the instrument has been initially set at 1000 gausses. As the shunting resistor is changed, the CALIBRATE control must be reset at 1000 gausses.

A resistive value is selected that places the 5000-gauss range 1% to 2% high and the 10,000-gauss range about 2% low. The value so obtained is Ra and is soldered across pins 5 and 7 of the probe plug. A resistor in position Rb may be used to further improve linearity. For most RFL InAs probes this Ra loading resistor varies between 2 ohms and 15 ohms when the probe is driven from the 5-ohm tap on the oscillator output transformer and the input impedance tap to the filter is set at 5 ohms. The internal driving impedance of the oscillator affects the linearity of the elements and in general should be kept high by using the 5 or 10-ohm output tap with the loading being accomplished with the resistor across the Hall contacts.

Calibration records on each range are provided for the probes and gaussmeter supplied on each order. These data permit measurement to a greater accuracy than the direct reading accuracy. Probes can be interchanged between units without loss of the direct reading accuracy. For highest accuracy, the probes should be calibrated on the instrument with which they are used.

The sensitivity of the "B" probe may be checked by measuring the AC voltage present at the output of the filter between pin 1 and term 8-10 of B probe or with 1000 gausses applied to the probe. The same applies to the "A" probe when measured between terminal 4-10 and 4-11 of oscillator HC-24845. The drive voltage for both "A" and "B" probes should be set carefully as outlined under calibration procedure (page 15). The sensitivity or signal output of the filter should be between .05 and .09 volt for 1000 gausses.

NOTE

If either probe has been damaged it may still be useable for flux density measurements on the higher ranges. If partial fracture of the element has occurred, the probe cannot be zero balanced to any useful accuracy on the low ranges but, by checking its zero balance on higher ranges, it can be determined if it will yield useful readings at these higher gauss levels. The scale readings above zero to which it can be balanced on a given range will indicate the accuracy of reading on that range.

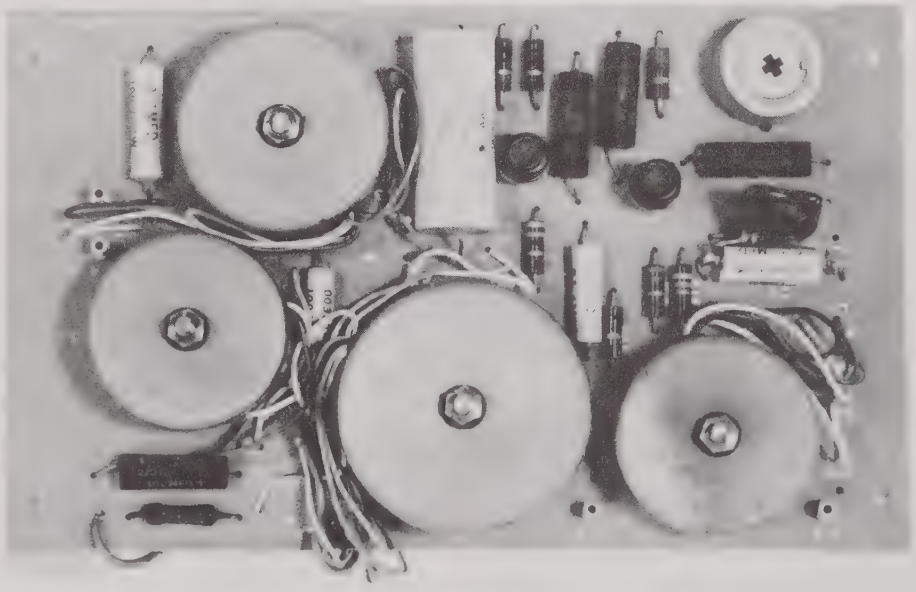


Figure 14. A Probe Oscillator and Filter Board.

A damaged probe cannot be used for differential measurements; both probes should be returned to RFL for proper matching and calibration when replacement of the damaged probe is desired.

Amplifier - The adjustment of the amplifier unit shown in Figure 15 consists of setting the input resistance of the amplifier to 2500 ohms and the setting of three gain controls. The input resistance of the amplifier is varied with the ADJ. control R55. Place a high impedance vacuum tube voltmeter between TP2 and the attenuator ground. With both probes plugged in the and RANGE SELECTOR set to LOW position and the GAUSSES FULL SCALE switch set to the 0.1-gauss position, adjust the A PROBE ZERO ADJ. - MEDIUM control until the voltmeter reads .004 volt. Then move the ungrounded voltmeter lead to TP1 on the attenuator and adjust R55 until the voltmeter reads .002; repeat operation until the voltage at TP1 is ½ the voltage at TP2. Since the multiplier resistor is 2500 ohms ±1% the test operation sets the input to the amplifier to 2500 ohms as required to obtain the correct attenuation on the other gauss ranges.

The over-all sensitivity of the amplifier is adjusted by means of the potentiometers R27, R41 and the CALIBRATE control R3. The maximum sensitivity (CALIBRATE control in maximum clockwise position) is set by varying R27 and R41 (on top of the amplifier) until .00375 volt on term 4-11 to 4-10 of the "A" channel filter brings the meter to full scale on the 100-gauss range with S2 set to HIGH. The input voltage is set up with the MEDIUM A PROBE zero setting control (use rear COARSE if necessary). The potentiometers R27 and R41 are first set in the center and both shifted, as required, to maintain approximately the same gain in each transistor amplifier pair.

To calibrate the LOW and HIGH range the following procedure must be observed. Place the RANGE SELECTOR S2 in the LOW position. Be sure unit has been zero balanced (page 11 Absolute Magnetic Field Measurements). Place probe in 100-gauss reference magnet adjust CALIBRATE CONTROL R3 for 100-gauss full scale. Place RANGE switch to HIGH range adjust R84 on the rear panel for the 100-gauss full scale. Place RANGE switch in HIGH and Gausses Full scale to 50,000. Place probe in 20,000 gauss standard and adjust R83 (50K CAL.) for 20,000 gauss reading.

To calibrate the attenuator, a complete set of reference magnets for the full-scale reading on each range is required. The attenuator resistance values are set so that, after calibration is performed with one reference magnet, the other full-scale values will fall within ±2%. For maintenance purposes a partial check on the attenuator and probes would be to set the CALIBRATE control for full scale on the 100-gauss MID range with the 100-gauss reference magnet, then measure this field on the 200 and 500-gauss ranges. No adjustment is provided in the attenuator, and a failure in the attenuator will normally require that the equipment be returned to the factory for repair. One probe can be used to check the other.

TROUBLE SHOOTING

If trouble develops in the Model 3265 follow the Trouble-shooting Chart of Table 5 and make the measurements shown in Tables 3 and 4 to locate the trouble.

The Table of Electrical Parts is for your convenience in ordering replacements when necessary.

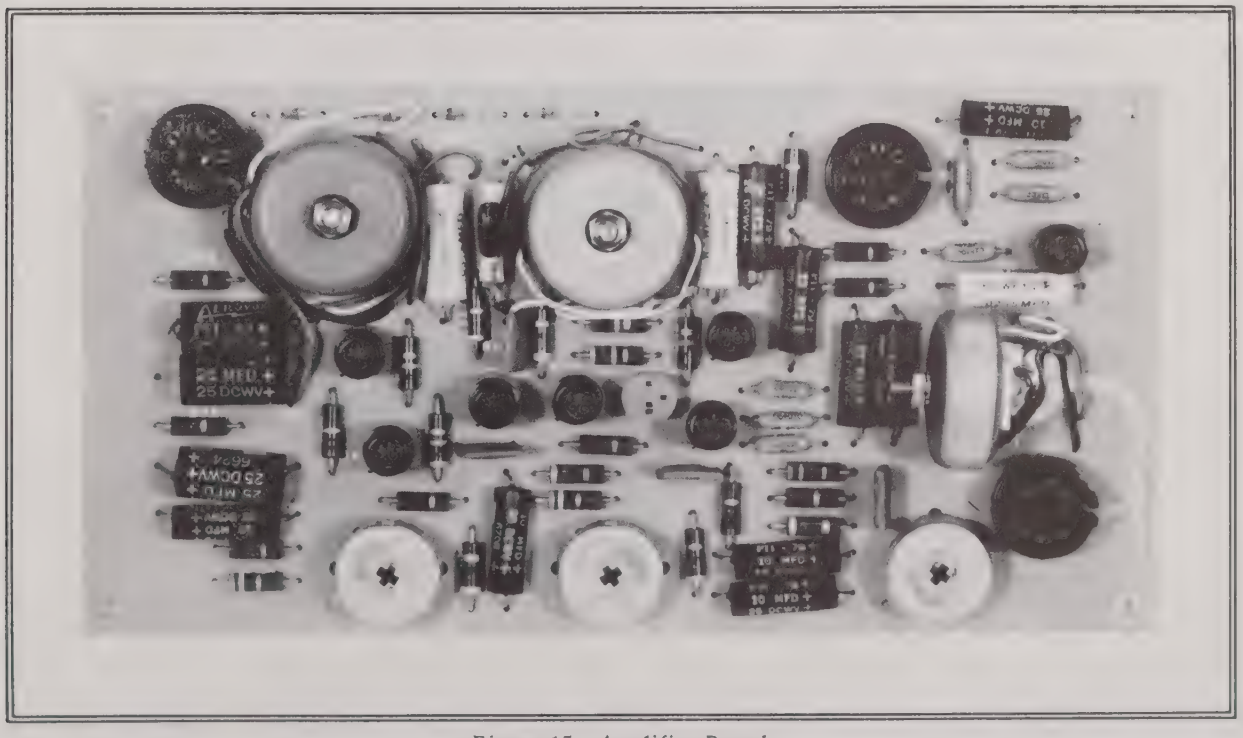


Figure 15. Amplifier Board.

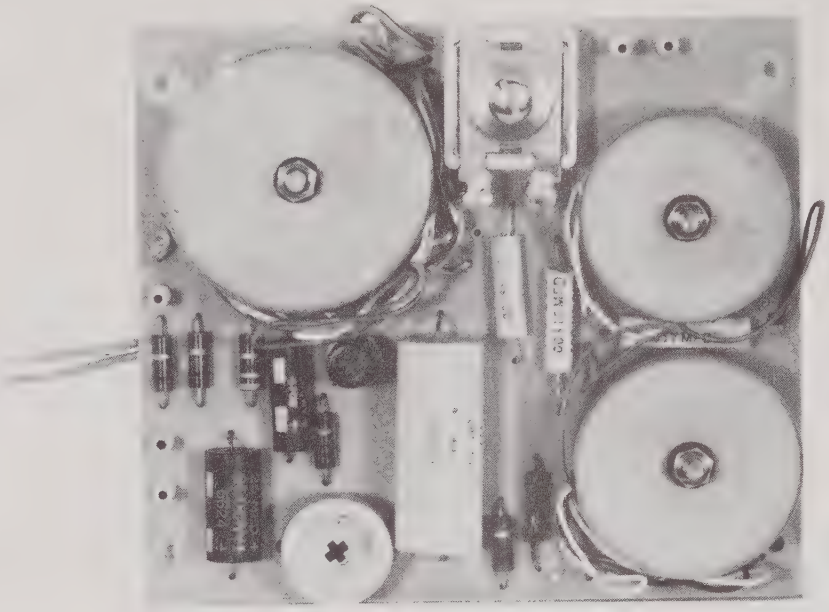


Figure 16. B Probe Oscillator and Filter Board.

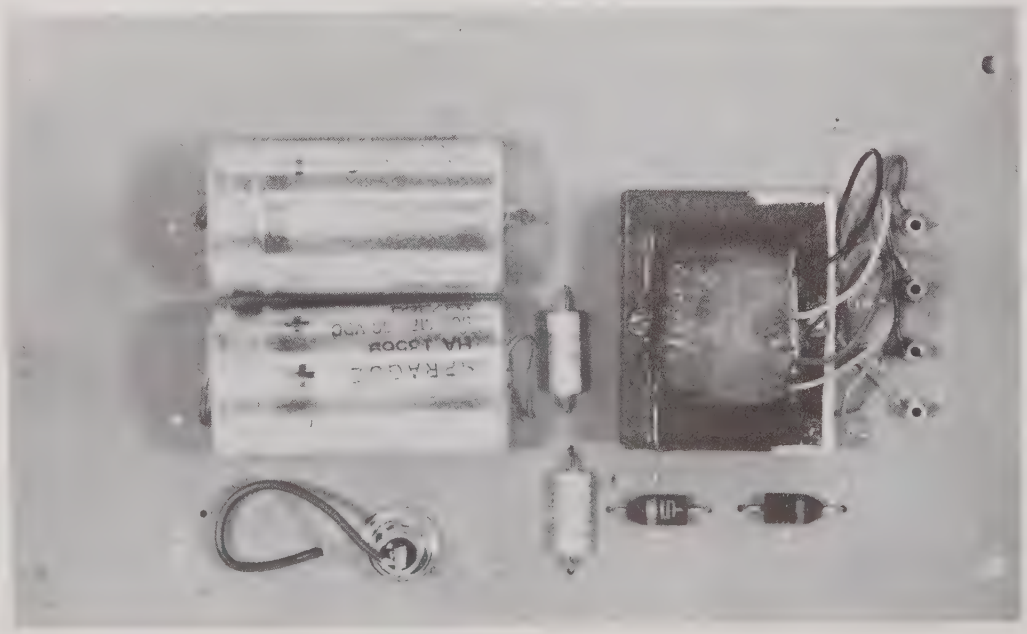


Figure 17. Power Supply Board.

TABLE 3
AC VOLTAGE CHART

AC LINE SUPPLY

NOTE
All measurements made with a high impedance vacuum tube voltmeter.

POINTS OF TEST	AC VOLTAGE
OSCILLATOR	
Q1 - B to GND	.1
Q1 - C to GND	4.3
Q2 - B to GND	.045
Q2 - C to GND	4.1
OSCILLATOR AMPLIFIER	
Q11 - B to GND	.049
Q11 - C to GND	3.9
Q11 - E to GND	.044
AMPLIFIER - 1000-gauss low range. (Range switch, 1K gauss).	1000-gauss field thru probe.
Q3 - C to GND	2.4
Q4 - C to GND	.0215
Q5 - C to GND	.066
Q6 - C to GND	.0024
Q7 - C to GND	.0042
Q8 - C to GND	.00022
Q9 - B to GND	.074
Q9 - C to GND	.9
Q9 - E to GND	.066
DIFFERENTIAL AMPLIFIER Same conditions as amplifier	
Q10 - B to GND	.00165
Q10 - C to GND	0.91

TABLE 4
DC VOLTAGE CHART

AC LINE SUPPLY

POINTS OF TEST	DC VOLTAGE
POWER SUPPLY - 115 V AC	
OSCILLATOR	
4-9- to GND	-18.5
Q1 - C to GND	-8.23
Q1 - B to GND	-1.35
Q1 - E to GND	-1.28
Q2 - C to GND	-16.5
Q2 - B to GND	-6.1
Q2 - E to GND	-5.95
OSCILLATOR AMPLIFIER	
Q11 - B to GND	-6.4
Q11 - C to GND	-16.5
Q11 - E to GND	-5.9
8-9 - to GND	-18.8
AMPLIFIER	
1-5- to GND	-19.3
Q3 - E to GND	-5.2
Q3 - B to GND	-5.3
Q3 - C to GND	-17.4
Q4 - E to GND	-0.15
Q4 - B to GND	-0.25
Q4 - C to GND	-5.3
Q5 - E to GND	-5.4
Q5 - B to GND	-5.5
Q5 - C to GND	-9.4
Q6 - E to GND	-0.1
Q6 - B to GND	-0.24
Q6 - C to GND	-5.5
Q7 - E to GND	-4.1
Q7 - B to GND	-4.1
Q7 - C to GND	-8.6
Q8 - E to GND	-0.65
Q8 - B to GND	-0.7
Q8 - C to GND	-4.1
Q9 - E to GND	-2.2
Q9 - B to GND	-2.2
Q9 - C to GND	-7.4
DIFFERENTIAL AMPLIFIER	
Q10 - B to GND	-2.5
Q10 - C to GND	-7.1
Q10 - E to GND	-2.5

TABLE 5
TROUBLE SHOOTING CHART

SYMPTOM	CAUSE	REMEDY
No pilot lamp on AC supply.	Blown fuse, faulty plug.	Check for shorts in the power supply and replace fuse. Measure DC output of power supply to be 18 volts ± 10%.
Zero Adjust Controls have little or no effect on any range.	Amplifier not functioning. Open potential leads in probe element	Check "B" probe by shorting pins 5 & 7 of J3 together and operate it's Zero Adjust Control. Check "A" probe by shorting pins 5 & 7 of J2. If meter can be zeroed, probe element leads or cable are faulty.
	Oscillator not functioning.	With "B" probe removed, check AC voltage between pins 1 & 2 of connector J2. If no voltage, troubleshoot the oscillator circuit and power supply. Check between pins 1 & 2 of J2 for "A" probe.
	Open current leads in probe element or open cable.	Measure with ohmmeter and replace probe or repair cable.
OSCILLATOR		
No oscillator output voltage.	Defective component in oscillator subassembly. Defective DC power supply circuit.	Troubleshoot oscillator circuit using Tables 3 & 4 for guides as to voltages. Troubleshoot power supply circuit.
AMPLIFIER		
Measure voltage of approximately .025 volt on terminals 4-11 to 4-10 (Gnd.) for 1000 gausses on "A" probe. The filter output for "B" probe is the same as "A" probe.	Defective filter.	Remove filter connections and test with 50 ohms input impedance and 5000 ohms on output. The step-up ratio is approximately 10. Bandwidth about 1000 Hz center frequency of 3000 Hz. Replace filter if defective.
No amplifier output indicated by meter.	Defective component in amplifier or meter circuit.	Signal trace circuit by applying 3000 Hz signal to input terminals generated by the Zero Adjust Controls.

Table of Replaceable Parts

DIAGRAM SYMBOL	QUAN.	NAME OF PART AND DESCRIPTION	RFL PART NO.
BT1, BT2, BT3	3	BATTERY, mercury cell 6.75V	HA-23807
C7, C8, C9, C16, C18, C19, C22, C25, C26, C29, C30, C31, C34, C35, C36, C38	16	CAPACITOR, Electrolytic: 10μF +75% -10%, 25V	HA-13167
C4, C5	2	CAPACITOR, Electrolytic: 500μF 50V	HA-13569
C12, C13 C14, C20, C39	5	CAPACITOR, Electrolytic: 25μF +75% -10%, 25V	H-1007-913
CR1, CR2	2	DIODE, silicon: F2	HA-10271
CR3	1	DIODE, silicon: 10M 19Z	HA-13918
CR4, CR5, CR6, CR7	4	DIODE	HA-28507
F1	1	FUSE: 0.15 Amp. 250V	HA-24773
X1	1	FUSEHOLDER	HA-1816
M1	1	METER, Milliammeter DC (Gauss)	HC-24829
P1, P2, P3	3	PLUG, tube base	HA-13260
T1	1	TRANSFORMER, power	HA-23287
Q2, Q11	2	TRANSISTOR, PNP: type 2N1925	HA-17179
Q1, Q3, Q4, Q5, Q6	5	TRANSISTOR, type 2N324	HA-9365
Q7 - Q10	4	TRANSISTOR, type 2N508A	HA-26954
J2, J3	2	SOCKET, tube	HA-13258
S4	1	SWITCH, slide: DPDT	HA-9267
S1	1	SWITCH, toggle: DPDT, Bat handle	HA-23250

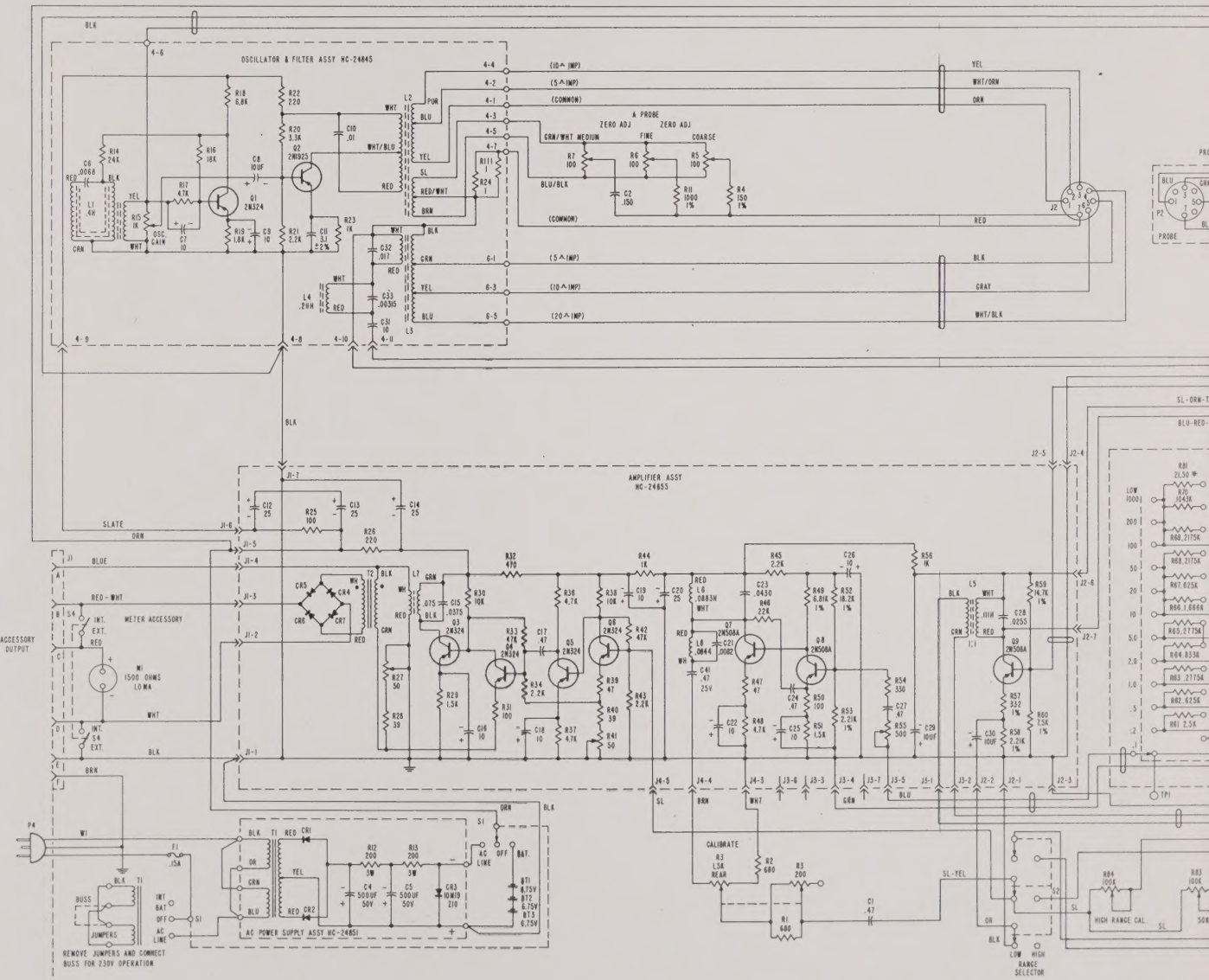
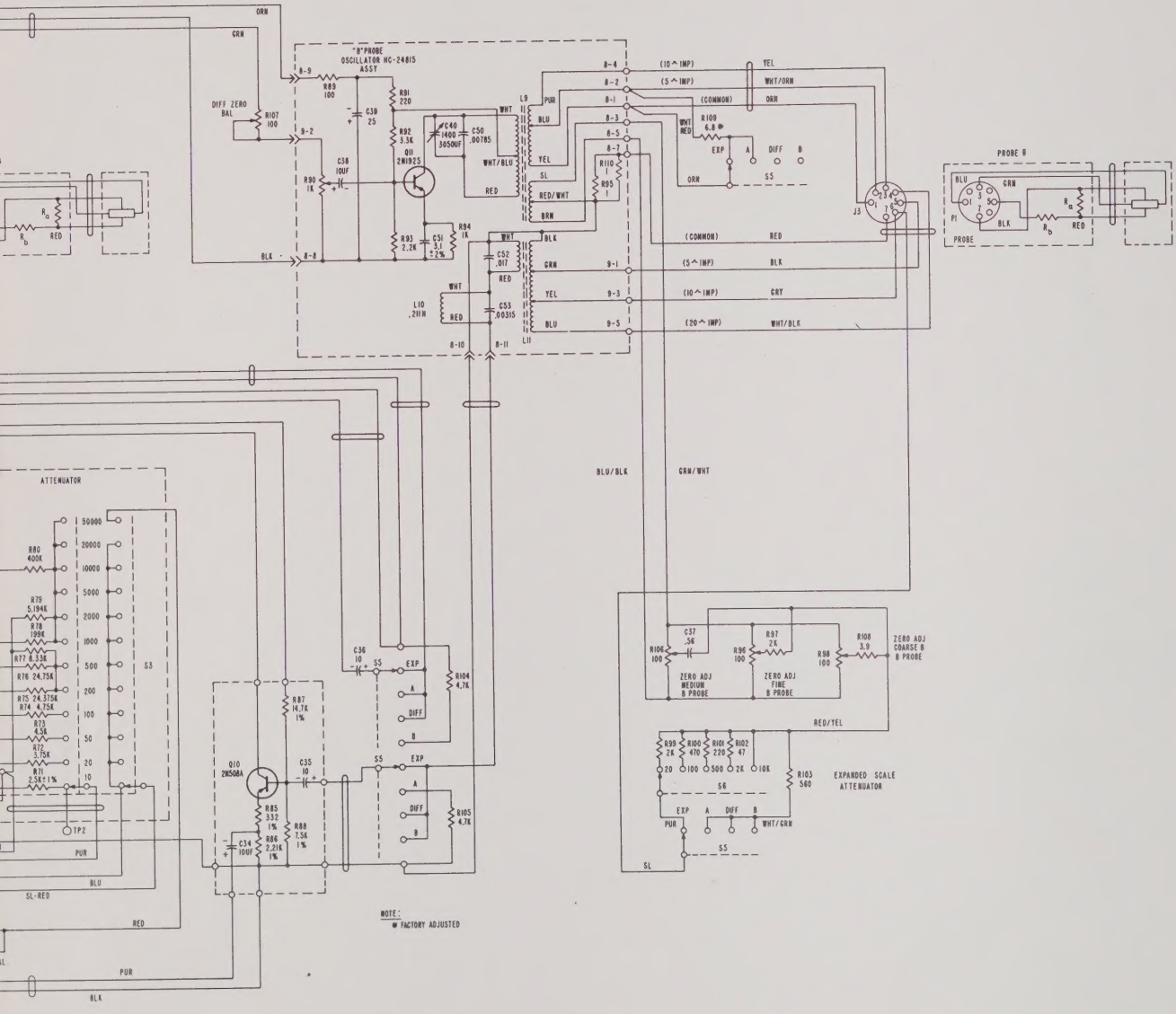


Figure 18. Schematic Diagram of Model 3265 Universal Gaussmeter.


"B" PROBE OSCILLATOR HC-2481S ASSY
DIFF ZERO BAL
R107 100
R89 100
R91 220
C39 25
R92 3.3K
C40 1400 - 3050UF
C50 .00785
Q11 2N1925
R90 1K
C38 10UF
R93 2.2K
C51 .1 ±2%
R94 1K
L9
L10 .2HH
L11
C52 .017
C53 .00315
R110 1
R95 1
R109 6.8 *
J3
PROBE B
PROBE A
ATTENUATOR
R80 400K
R79 5.194K
R78 190K
R77 8.33K
R76 24.75K
R75 24.375K
R74 4.75K
R73 4.5K
R72 3.75K
R71 2.58K 1%
S3
TP2
R87 14.7K 1%
R85 332 1%
R86 2.21K 1%
R88 7.5K 1%
C34 100UF
C35 10
Q10 2N5088
C36 10
R104 4.7K
R105 4.7K
S5
S6
C37 .56
R106 100
R96 100
R97 2K
R98 100
R108 3.9
ZERO ADJ MEDIUM B PROBE
ZERO ADJ FINE B PROBE
ZERO ADJ COARSE B PROBE
R99 2K
R100 470
R101 220
R102 47
R103 560
EXPANDED SCALE ATTENUATOR
(10 ^ IMP)
(5 ^ IMP)
(COMMON)
(20 ^ IMP)
EXP
A
DIFF
B
NOTE:
* FACTORY ADJUSTED

Warranty

The Model 3265 Universal Gaussmeter carries a warranty of 12 months from date of delivery for replacement of any part, except probes, which fails during normal operation or service. A deficient part should be returned to the factory, shipping charges prepaid, for replacement f.o.b. Boonton, N. J.

RFL Industries, Inc.

Boonton, New Jersey, U. S. A.

RFL Industries, Inc.

INSTRUMENTATION DIVISION • Boonton, New Jersey 07005

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